BROOKHAVEN NATIONAL LABORATORY

fact Muon Collaboration

Linac Acceptance

J. Scott Berg

Advanced Accelerator Group Meeting

10 February 2005

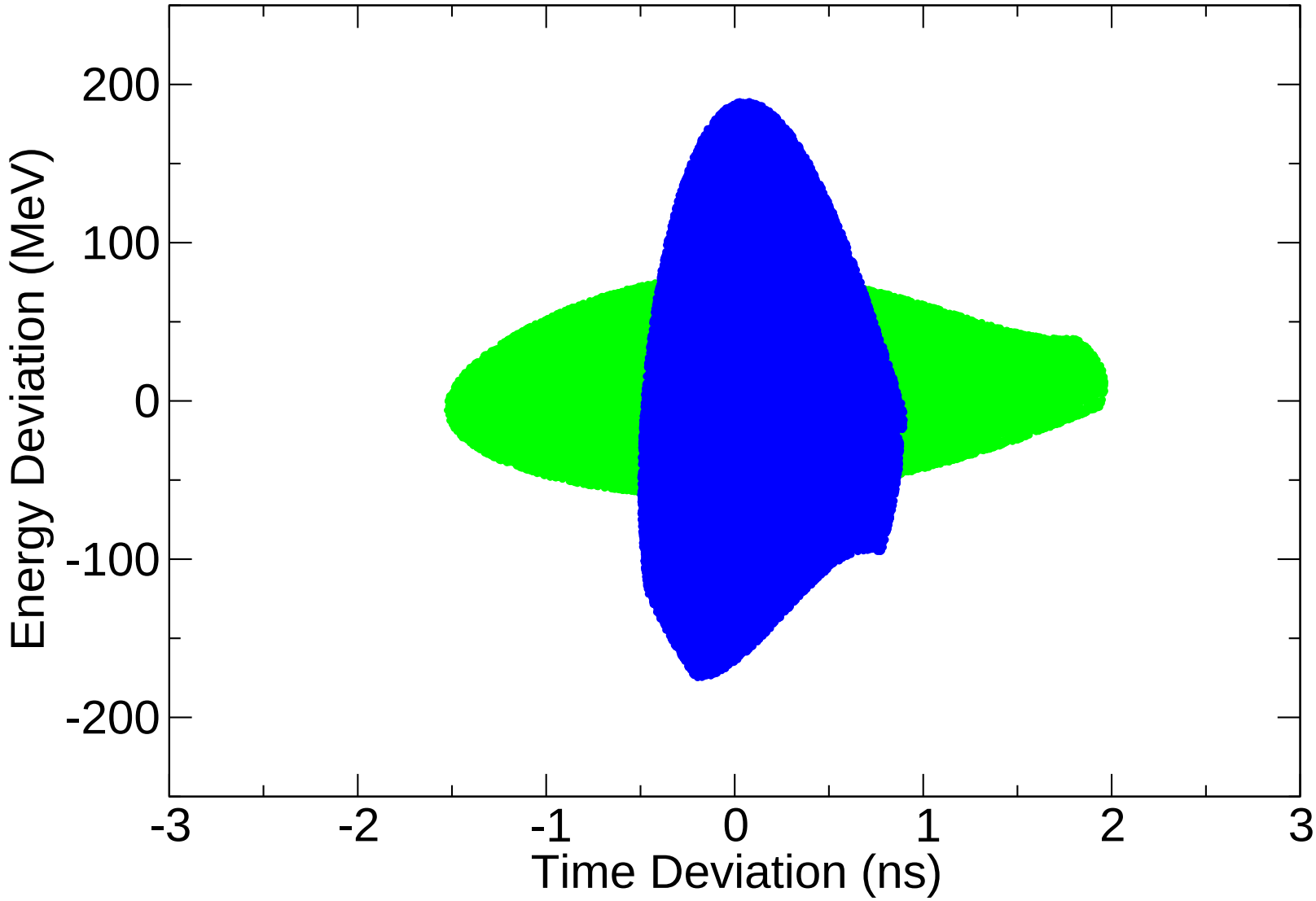
Linac Analysis Procedure

- Analyze linac based on smoothed approximation
- Accelerate total energy 290 MeV to 1.5 GeV
- Choose phase and gradient as a function of energy
  - Transit time factor depends on energy
  - Length of cryomodule depends on energy
- For this example, assume constant gradient, 8.5 MV/m
  - Lowest real-estate gradient in real linac
  - Include transit time factor in addition to this
- Phase profile (0 is crest)

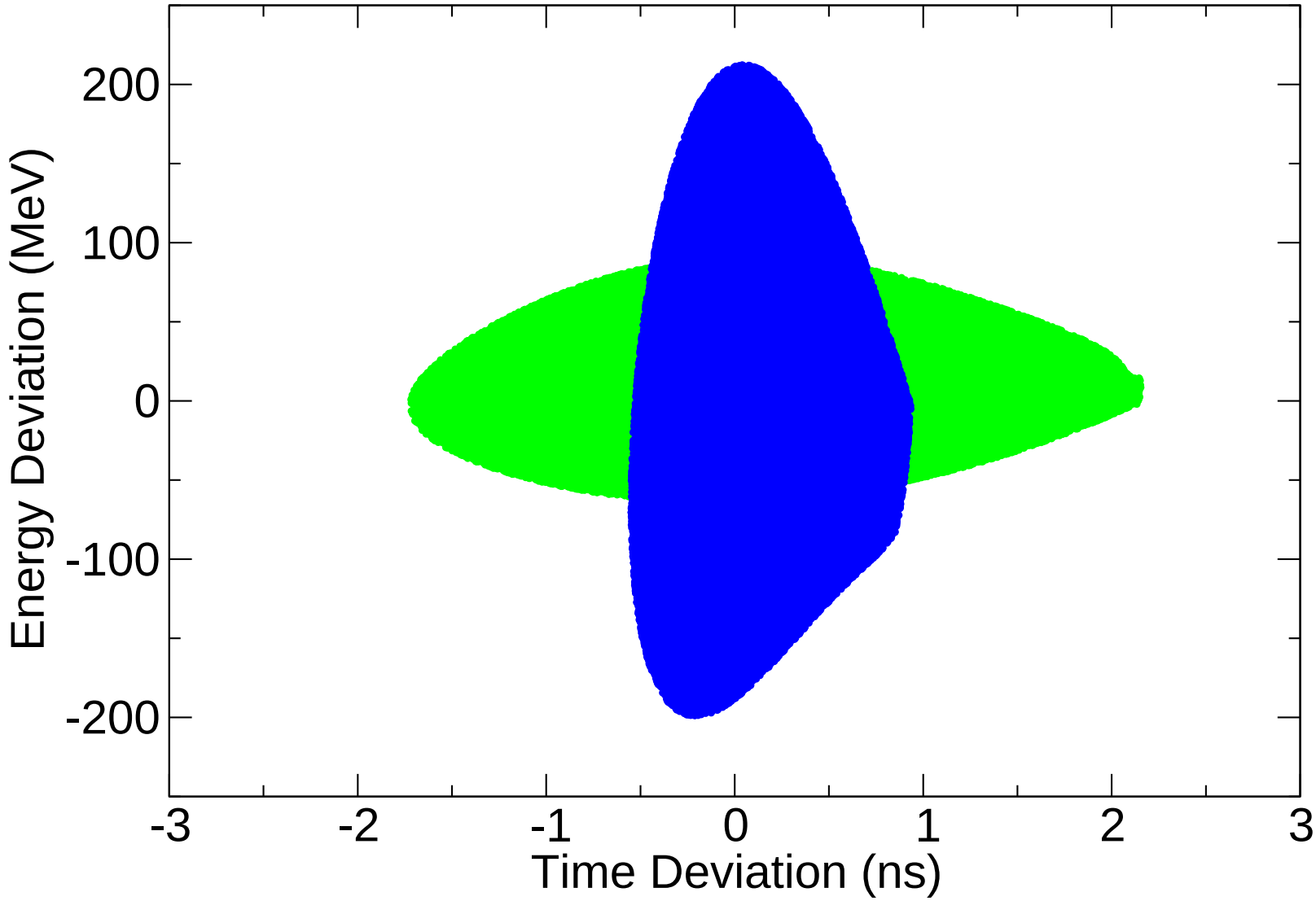
$$\phi(E) = \phi_0 \frac{(E - E_{\text{min}})}{E_{\text{max}} - E_{\text{min}}}$$

  - Look at different values of ϕ_0

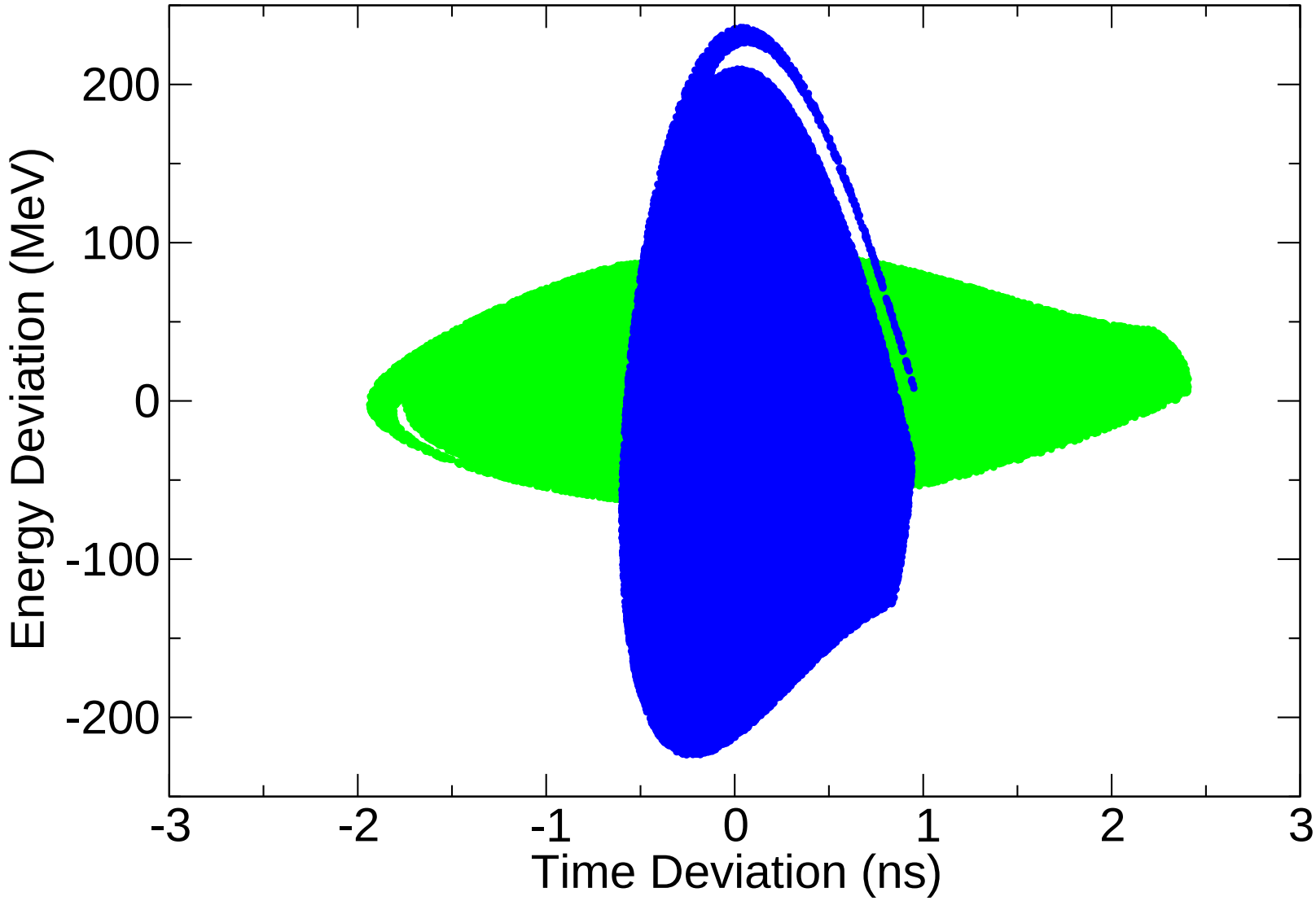
$\phi_0 = 75°$


Energy Deviation (MeV)
200
100
0
-100
-200
-3
-2
-1
0
1
2
3
Time Deviation (ns)

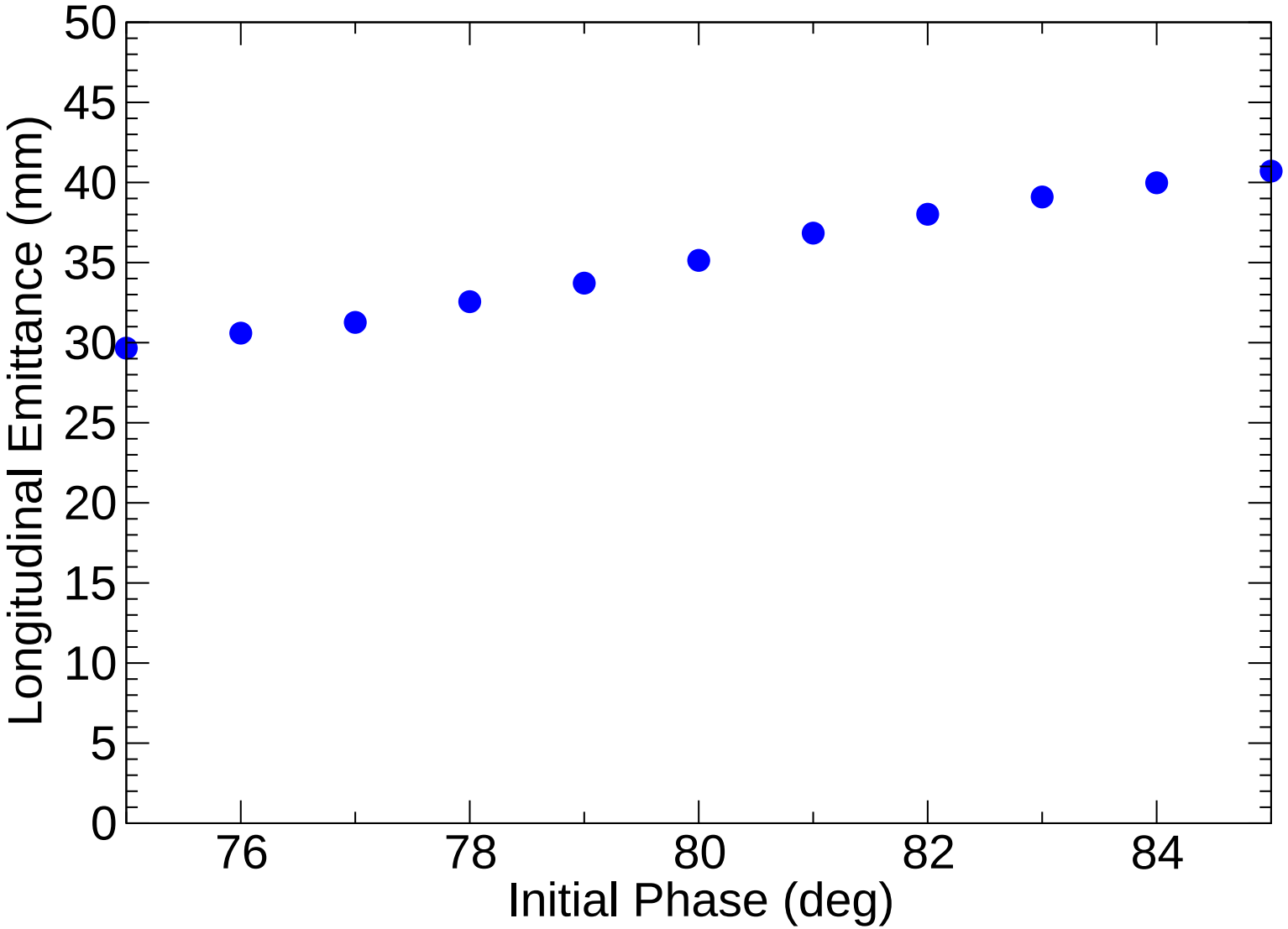
$\phi_0 = 80°$


Energy Deviation (MeV)
200
100
0
-100
-200
-3
-2
-1
0
1
2
3
Time Deviation (ns)

$\phi_0 = 85°$


Energy Deviation (MeV)
200
100
0
-100
-200
-3
-2
-1
0
1
2
3
Time Deviation (ns)

Emittance vs. Initial Phase



Concluding Remarks

- Starting further off-crest gives significant improvement in acceptance
  - Cost will be longer linac!
  - Decays may negate gain (need to optimize)
  - Gain may be leveling off (?)
- Need to get bunch from 200 MeV/c
- Consider non-linear phase profile: add quadratic
- Put in increasing gradient as energy goes up